



Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

Bee Fork

Water Body Segment at a Glance:

County: Reynolds
Nearby Cities: Centerville
Length of impaired segment:
 Water Body ID
 2760 8.5 miles
 2760U-01 0.3 mile
Pollutant: Lead (S)¹ and Toxicity
Source: Fletcher Mine



State Map Showing Location of Watershed

Scheduled for TMDL development: 2012

Description of the Problem

Beneficial uses of Bee Fork (WBID 2760)

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption)
- Whole Body Contact Recreation

Bee Fork (WBID 2760U-01) is unclassified and, therefore, no beneficial uses are assigned to it.

Uses that are impaired

- Protection of Warm Water Aquatic Life
- General Criteria

Standards that apply

- Missouri Water Quality Standards found in 10 CSR 20-7.031(4)(B)1 state:

Water contaminants shall not cause the criteria in Tables A and B to be exceeded. Concentrations of these substances in bottom sediments or waters shall not harm benthic organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.

- When a Missouri stream is unclassified, it is protected by the general criteria found at 10 CSR 20-7.031(3). Toxicity is also addressed through the general criteria. The particular general criteria that apply to Bee Fork include:

¹ (S) = pollutant is in the soil

- (D) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life.
- (G) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

- Missouri has no standards for lead in sediment (Lead (S)). Likewise, the U.S. Environmental Protection Agency has not yet established federal guidelines for toxic chemicals in stream or lake sediments. In lieu of such criteria, Probable Effect Levels suggested by McDonald, et. al², are used. PELs are the concentrations at which some toxic effect on aquatic life is likely

Background information and water quality data

Fletcher Mine is an active lead mine located near Centerville in northern Reynolds County, Missouri. It is run by the Doe Run Company. The U.S. Geological Survey, or USGS, has been studying toxicity of waters and sediments in the “new lead belt” of southeastern Missouri for several years to see what effect the mining has on the streams with which it is associated. This includes Bee Fork, a tributary to West Fork Black River. Toxicity testing of aquatic species by USGS in March 2004 indicated some toxicity in the first Bee Fork site on the classified segment downstream of the Fletcher mine/mill (Site #4 on map on last page).

In 2003, the department switched from using pore water, the water that fills the spaces between sediment particles, to a solid phase method, which involves soaking the sediment in water to measure the toxicants. The results of toxicity tests using the Microtox procedure³, and tests using *Ceriodaphnia dubia* (water flea) and *Hyalella azteca* (a tiny amphipod), showed that two of six samples collected in Bee Fork in 2007-08 indicated toxicity (Table 1). Because there were two occurrences of toxicity in the past three years of data, Bee Fork is judged to be impaired for sediment toxicity. Based on water and sediment sampling, the toxicity appears to be due to lead.

Table 1. Toxicity Data for Bee Fork, 2007-08

Site*	Species	Control Survival Rate (%)	Control Reproduction Per Female/Survivor	Survival Rate (%)	Reproduction per Female/Survivor
4	<i>Hyalella azteca</i>	82	8.8	59	8.2
4	<i>Ceriodaphnia dubia</i>	100	20.1	0	0
3	<i>Hyalella azteca</i>	96	4.6	100	8.2
4	<i>Hyalella azteca</i>	96	4.6	91	5.1
5	<i>Hyalella azteca</i>	96	4.6	99	2.6
6	<i>Hyalella azteca</i>	96	4.6	84	3.9

*Site numbers correspond to sample sites located on the last page. Sites 1, 2 and 3 are on the unclassified segment of Bee Fork.

² *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*, D. MacDonald, et al., 2000

³ The Microtox test uses a saltwater alga instead of freshwater species. Because this alga does not have the same sensitivity to all toxicants as the most sensitive freshwater fauna in Missouri, it is not a definitive test for the presence or absence of toxicity in Missouri streams or lakes. It does, however, give some indication for potential toxicity and relative toxicity where several waters are tested.

The unclassified segment of Bee Fork was added to the 303(d) List based on sediment toxicity. Sediment chemistry data (Table 2) collected by USGS (Feb. 2004) and the department (July 2008) indicated lead in sediment is more than 150 percent of the Probable Effect Level, or PEL, the level at which adverse effects on the aquatic biota are expected to begin.

Table 2. Sediment data for Bee Fork

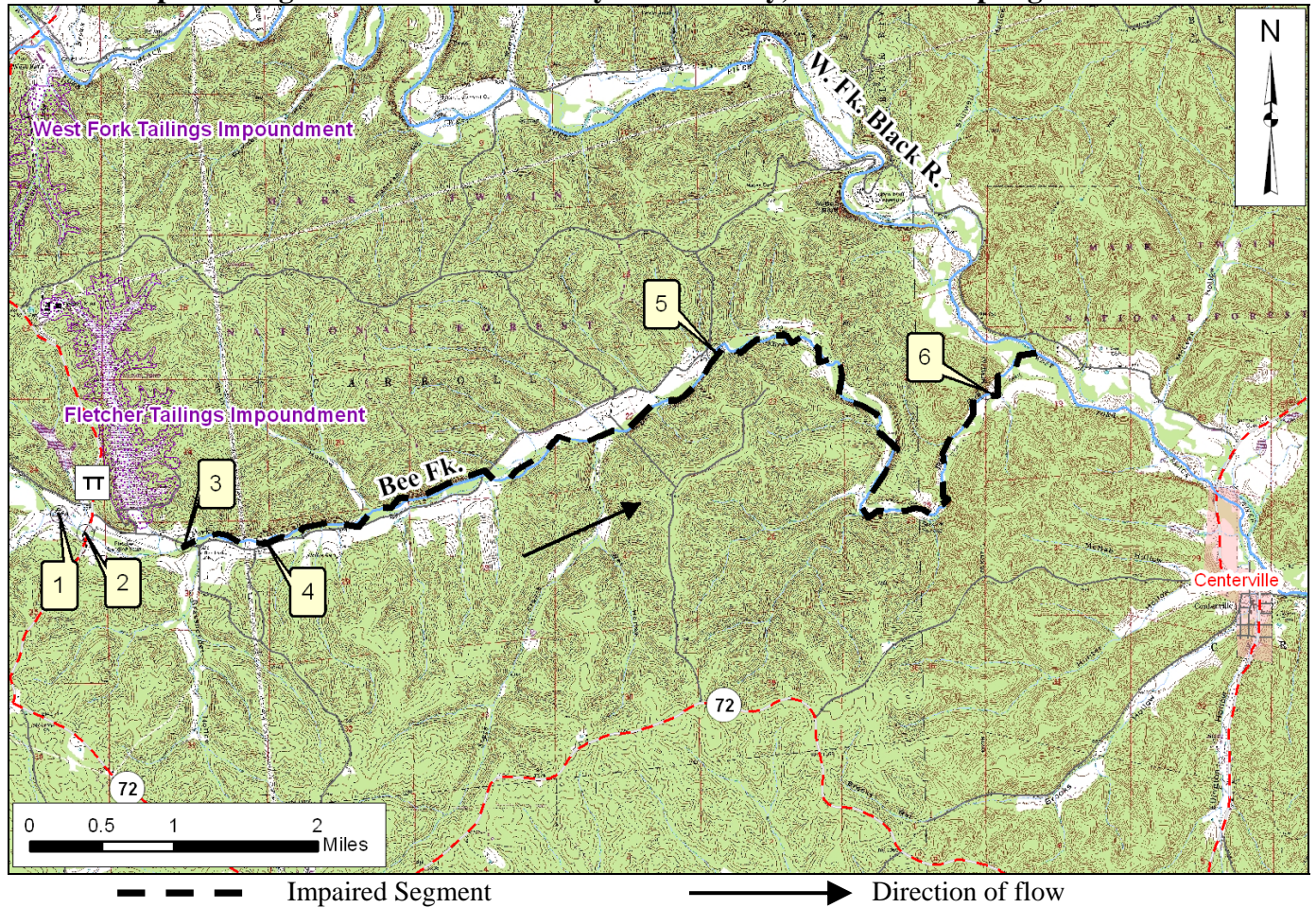
ORG	SITE	YEAR	SITE NAME	Pb (mg/kg)
USGS	2	2004	Bee Fork @ Hwy TT	448
MoDNR	3	2008	Bee Fork 0.7 mi. below Hwy TT	186
			Mean	317
			Probable Effect Level	128

Note: mg/kg = milligrams per kilogram, or parts per million

Contamination of stream sediments has led to the contamination of fish and other aquatic life. New studies are showing that the lead and other metals in these tailings are toxic to mussels, crayfish and other small invertebrates that inhabit the bottom of the river. It is already known that lead bioaccumulates in the bodies of aquatic creatures, which has been documented in the levels of lead in fish in Big River.

A map showing Bee Fork and the sampling sites may be found on the following page.

Impaired Segment of Bee Fork in Reynolds County, Mo. with Sampling Sites



Sample Sites

- 1 – Bee Fork 0.3 miles above State Highway TT
- 2 – Bee Fork at State Highway TT
- 3 – Bee Fork 0.7 miles below State Highway TT
- 4 – Bee Fork below Grasshopper Hollow
- 5 – Bee Fork below South Branch
- 6 – Bee Fork near mouth

For more information call or write:

Missouri Department of Natural Resources

Water Protection Program

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